In-flight Sorting of BNNTs by Aspect Ratio

Completed Technology Project (2016 - 2017)

Project Introduction

The key technical challenges are: (a) mechanical sorting is ineffective for nanoscale product, (b) BNNTs are non-conductive and the agglomeration tendency is strong, and (c) organic solvents damage BNNTs. Consequently, cyclone separator technology will be a good initiation point, but electrostatic or triboelectric precipitator technology offers the most potential. In the more mature CNT production industry, dry cyclonic techniques operating at elevated temperatures are already employed. However, the CNT material accumulates as a single entity, and sorting of the end product by mass, size, or shape has not been implemented.The key objectives for the first year are an extensive literature review to compare/contrast promising techniques. External collaborators will actively be sought from academia and industry. As concepts are developed, a White Paper will be published and a New Technology Report will be filed. A plan will be formulated for a Tier 2 effort, which will define the research required for technology advancement.

Anticipated Benefits

Bulk quantities of BNNTs are only available as tangled masses comprising a mixture of macroscopic characteristics. The use of BNNTs as reinforcing agents for structural composites will require the delivery of product with a homogeneous morphology, i.e. uniform aspect ratio. Currently, BNNTs accumulate in the reactor or are captured in filters using the incumbent mass production methods. The processes are interrupted for manual removal of bundles of fibril-, cloth-, and cotton candy-like materials. Post-synthesis operations purify and classify the product, typically using wet separation techniques.The organic solvents which are typically employed for CNTs are detrimental to the properties of BNNTs. Unique to the proposal is the fractionation and collection of BNNTs on exit from the synthesis reactor using dry separation techniques and no filters. The initial approach will be conducted at ambient temperature, but the ultimate goal is in-flight sorting and binning of BNNTs by aspect ratio at synthesis operating temperatures. The absence of mechanical interactions, filters and organic solvents will minimize damage to the BNNTs.

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Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Center Innovation Fund: LaRC CIF

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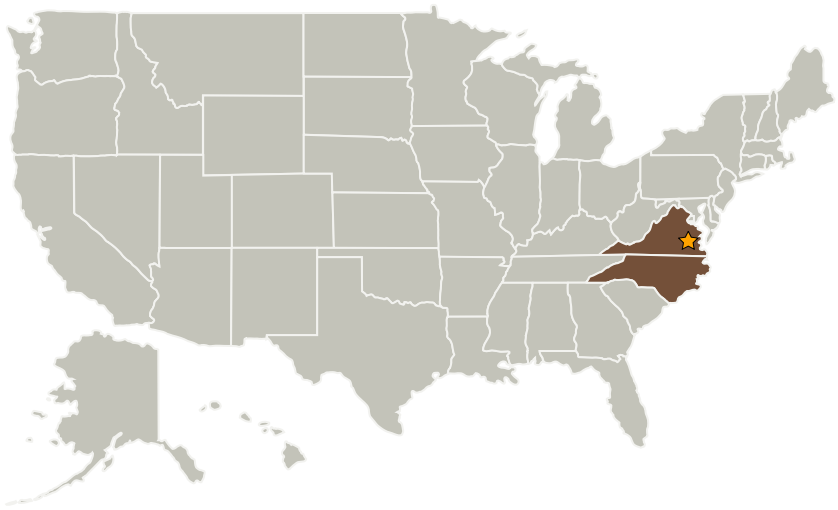
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Advanced Cyclone Systems	Supporting Organization	Industry	Porto, Outside the United States, Portugal
ERIEZ Corporation	Supporting Organization	Industry	
North Carolina State University at Raleigh	Supporting Organization	Academia	Raleigh, North Carolina

Primary U.S. Work Locations	
North Carolina	Virginia

Project Management

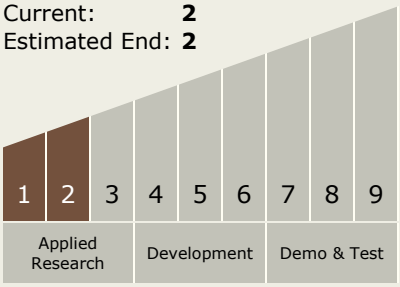
Program Director:
Michael R Lapointe

Program Manager:
Julie A Williams-byrd

Principal Investigator:
Stephen J Hales

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.3 Manipulation
    - TX04.3.4 Sample Acquisition and Handling

Target Destinations

Earth, The Moon, Foundational Knowledge